pv	Penisvalvae, or valves of male genitalia.	t	Tegula.
s	Sternum.	tb	Tibia.
sa	Subalare, or subalar plates.	tc	Trochanter.
sc	Scutum.	ts	Tarsus.
scl	Scutellum.	u	Postuneus, or terminal hook of penis valve.

EXPLANATION OF PLATE.

Fig. 1. Lateral view of head and thorax of dealated female. The parts of the neck and prothorax are abnormally distended.

Fig. 2. Lateral view of terminal structures of apterous male, with genitalia extruded.

Fig. 3. Dorsal view of genital valves of apterous male. The basal portions of the valves, being imbedded in the genital tissues, are not drawn.

Fig. 4. Lateral view of terminal structures of dealated female.

Fig. 5. Frontal view of head of dealated female.

Fig. 6. Dorsal view of thoracic region of dealated female. The parts of the prothorax are abnormally distended in this specimen.

DIRECT SUNLIGHT AS A FACTOR IN FOREST INSECT CONTROL.

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Control and preventative measures in Forest Entomology are necessarily based on different principles from those commonly used against orchard, field or truck crops. The inaccessability of many of the regions, the enormous area involved, and the low annual returns on the investment demand protective measures that can be correlated with systems of forest management or lumbering practices at the least expense.

This requirement has been the basis on which all control or preventative measures are formulated. To quote from Dr. Hopkins:[1]

"The desired control or prevention of loss can often be brought about by the adoption or adjustment of those requisite details in forest management and in lumbering and manufacturing operations, storing, transportation, and utilization of the products which at the least expenditure will cause the necessary reduction of the injurious insects and establish unfavorable conditions for their future multiplication or continuance of destructive work."

As examples of such methods are the cutting or girdling of certain woods at definite seasons of the year to prevent attack

[1] Some Insects Injurious to Forests: Insect Depredations in North American Forests and Practical Methods of Prevention and Control. Bulletin 58, Part V, Bur. Ent., U. S. Dept. of Agric.

by insects, submerging in mill ponds during the flight periods, and rapid utilization of the felled timber before the insects have had time to injure it.

It was accidentally discovered by the writer that direct exposure to the sun can be utilized in connection with forest management and lumbering practices as a highly efficient method of prevention or control of certain of the more destructive tree-killing and wood-boring insects.

In the summer of 1917 several hickory logs containing *Cyllene pictus* (Drury) in the pupal and immature adult stages were accidentally left in direct sunlight for several hours. Later in the same day these insects were removed from their cells and isolated in vials. As they were taken out it was found that many from the top side of the logs were dead. This discovery, together with the well known fact that logs exposed to direct sunlight are in many localities attacked only on the under surface, immediately suggested possibilities of utilizing the heat of the sun in control or prevention of damage by certain insects. The same summer a few tests were made by turning both infested and uninfested logs in the sun which gave promise of future possibilities where other methods were not practical.

Since then further experiments have been made at Falls Church, Va.; Vicksburg, Miss., and Tucson, Ariz., giving conclusive evidence as to the effectiveness of this method under certain conditions. The experiments were primarily based on the turning of infested logs in the sun and a series of observations on about three million feet of ash logs cut at different seasons and handled in various ways.

In the following paragraph several examples of these preliminary experiments are given to illustrate the effectiveness of this method.

At Sabino Canyon, Ariz., during June, 1918, an assortment of infested mesquite sticks containing several species of Bostrichids, both larvae, pupae and adults, several species of *Chrysobothris* larvae and larvae of *Cyllene antennatus* were removed from partial shade where they had been infested and placed in the direct sunlight. Two days' exposure killed 40% of all larvae, pupae and adults to the depth of one-half inch, one week's exposure 75% to depth to three-quarters of an inch, and two weeks' exposure over 90% to the same depth.

From June to September uninfested green mesquite sticks were laid out in the sun and turned weekly for 4 to 10 weeks, then placed in the shade. A few *Chrysobothris* and Bostrichids attacked the under side of the logs at first but all were killed during turning and no subsequent attack resulted.

At Vicksburg and Delhi, Miss., during May, 1918, ash logs cut at various times during the preceding six months, some of which had been submerged for various periods, were exposed to the sun as described for the mesquite. Most of the earlier cuts were infested with ambrosia beetles and *Neoclytus erythrocephalus* larvae, while many of those recently felled contained no insects. Weekly turning of these logs killed all insects on or beneath the bark and the uninfested logs were not subsequently attacked by the following November.

At Falls Church, Va., June 1, 1919, ash, pine, oak and hickory sticks that had previously been submerged in water 6½ and 8½ months and, therefore, particularly suitable for the attack of ambrosia beetles were removed from the water and exposed to the sun. They were turned weekly during June, July and August. Ambrosia beetles immediately attacked on the under surface. The first turning killed all these beetles before they had entered more than one-quarter inch into the sapwood. On following turnings the underside was likewise attacked and the beetles subsequently killed. This was repeated for four weeks, after which the sticks were sufficiently dried to prevent further attack, and no beetles penetrated far enough into the wood to cause any injury.

Experiments at the same place in July, 1919, demonstrated that various species of Scolytid adults and larvae and *Monohammus titillator* larvae in pine could be killed or their attack prevented by the same measures.

Experiments have since been undertaken to determine the sections of the country where this method can be utilized, the season of year during which it is effective, and what constitutes killing temperatures and their relation to humidity. A few observations have shown that the inner bark on logs exposed to direct sunlight may reach a higher temperature than the surrounding air by as much as 60°, depending on the locality, the condition of the sky and the angle of the sun's rays.

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